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Science News ..... *Supplement*

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THE GIFTED STUDENT AND RESEARCH[1]

LIKE the evolution and development of society, the development of the individual is rapidly coming under more and more consciously and systematically directed control; witness the gigantic educational machinery which is the product of the last twenty years. It is, perhaps, safe to say that the systematic direction of the development of the individual is inversely proportional to his initiative, natural gifts and creative power. Morons are cared for; delinquent students are sorted and served each according to his individual need; the average student follows a routine. But what about the intellectually gifted student? Ordinarily he is held in leash. Let me enter a plea for the emancipation of the gifted student, giving him a realization of his powers and responsibilities, the freedom to soar unhampered above the levels of mediocrity, and to live at his highest level of achievement, weaving early his bonds of friendship with scholars. Instead of whipping him into line, let us whip him out of line.

One of the great contributions from modern psychology is the discovery of the individual and the projection of his profile, here and there in quantitative terms, bringing to us the realization that in a given specific mental capacity one individual may have two, five, ten, twenty-five or a hundredfold the capacity of another with whom he is tied up in the educational mold. Our curriculum and our campus sanctions are so effectively set that very often these individual differences are successfully covered up or smoothed out so that the gifted individual as such is lost to himself as well as to society.

A few years ago, particularly during the

[1] Read before the Association of American Universities at Baltimore, Maryland, November 9-11, 1922.

war, some of us were interested in finding from the senior class in college those who would give the greatest promise of achievement in research work. The rating blank[2] I have placed in your hands was used effectively for the locating of a certain per cent. of these. Personally I can testify that the individual interviews with those selected on the basis of these ratings furnished one of the most delightful and profitable opportunities for personnel work in administration. With the charts before the student and the interviewer, it was possible to enter into the life plans of the individual at a crucial stage in his career and cause him to view the situation in a critical attitude with profound interest. This is a procedure which has amply justified itself. But we soon found that the senior year is too late. At the end of the senior year the student has already chosen his career and, sad to say, often unwisely, being guided largely by temporary emoluments, a shortsighted estimate of what is worth while, or the easiest outlet for activity at his then recognized level. Business, the industries, special interests, and the older professions have plucked from the senior class those who are most promising. Without strong traditions in their favor and without the promise of financial rewards, science and art, with very few exceptions, trusting to luck, get what is left. It has therefore become clear that some selection, to be effective, should be made earlier than in the senior year, first, to give scholarship an opportunity in the competition for talent, and, second, to find the gifted student early enough to give him the advantages of preparation that he may crave and deserve.

For this reason, some of us fall back on the opportunity of using the so-called intelligence tests and various substitutes for these at college entrance. These tests should be as much for the purpose of discovering the gifted student as for the purpose of culling out at the lower end. If I may mention a practice which has gradually found its way into Iowa, I may say that those who rank in the highest 10 per cent. at college entrance are summoned by the Dean of the College of Liberal Arts and told

[2] ANALYZED RATING OF FITNESS FOR GRADUATE STUDY

Directions: Record your judgment on each capacity by placing a check mark (V) at the appropriate point in the dotted line. Grade conservatively, bearing in mind that in the long run, for a class, there should be as many marks below average as above. If in serious doubt, put a question mark above the check. Guard rigorously against giving information to, or receiving from, others who are rating independently, but otherwise consult freely with those who know the student well.

At the bottom, cite (1) notable specific evidences of achievements, distinctions, opinions or other data that may throw light on the character of, ability or fitness for some particular field, if you know of any; and (2) mention marked negative traits which might be an obstacle in a learned career.

	Very poor 10%	Poor 20%	Low average 20%	High average 20%	Excellent 20%	Superior 10%
1. REASONING POWER: capacity for solving problems, both deductive and inductive						
2. ORIGINALITY: creative imagination, brilliancy, planful initiative and fertility of rational ideas						
3. MEMORY: extensive, logical, serviceable, and ready command of facts						
4. ALERTNESS: quick, incisive and responsive observation, thought and feeling						
5. ACCURACY: precise, keen, regular and reliable observation, thought and feeling						
6. APPLICATION: power of concentration, sustained attention, persistence, and well-regulated effort						
7. COOPERATION: capacity for intellectual companionship, team work and leadership						
8. MORAL ATTITUDE: intellectual honesty, wholesome moral standards, ideals and influences						
9. HEALTH: nervous stability, physique, vitality, and endurance						
10. ZEAL FOR INVESTIGATION: deep interest in and craving for original and creative work						

that the institution recognizes individual differences both in regard to quantity and quality; that those having given evidence of unusually high powers will be expected to show unusually high achievement through the college course; that they will be watched with hopeful interest by members of the faculty; that an effort will be made to give them such personal direction and stimulation as they may need; and that eminent leadership is characterized by modesty and service.

At the beginning of the second year, the Dean of the Graduate College summons them. Each one is asked to bring three ratings on the blank you have seen; one by himself, one by a student friend, and one by an instructor. In the light of these analyzed ratings and the achievement of the freshman year, we talk over the situation with them individually in preparation for the selection of their major at the beginning of their junior year. This usually leads to an early introduction to the most inspiring men in the major subjects which they are to elect. The selection of a major is then a distinctive step in the finding process, and the selection of an adviser ceases to be a mere form or a mere tool of administration. This procedure has served also to give members of the faculty, who are interested in research, a fresh interest and a clear point of view in the effort to discover in their classes other persons who show evidence of talent for research; because the gifted students do not necessarily fall in the highest group in mental tests.

But even this approach in the freshman and sophomore years has revealed to us the advantage of beginning still earlier. As was shown by Book in the Indiana survey, dull students are as likely to go to college as bright students. In the interest of scholarship it would be extremely wholesome if those who are interested in college entrance could reach down into the high school and inject into that atmosphere the sentiment that the more gifted a student is in the secondary school work, the more desirable it is that he should go to college. It is only by the cultivation of a personal sentiment of this kind that we can draw into the college those high school students of superior attainment whose education is now curtailed.

What I have attempted to say so far is that it is in the interest of creative scholarship as well as culture in general that we should frankly recognize the enormous magnitude of differences in the individual capacity for achievement and that this principle should be asserted early in the course; first, that students may be found in the adolescent period of enthusiasm and generous aspiration and wisely protected from the machinery which is set automatically to grind high and low to a common grade; and, second, that instincts of curiosity, criticism, collecting and comradeship which blossom in the early adolescent period may be fostered in an atmosphere of freedom, encouragement and opportunity for achievement.

Having thus entered upon a program of doing what we can to discover the gifted student, what can we do to follow up this discovery in the undergraduate course? This question has been answered by a very elaborate report prepared for the Association of American University Professors by Professor Wilkins pointing out sixty-seven varieties of things that may work to this end. I shall not here attempt even to summarize or classify these as they will undoubtedly appear in a formal report of his committee.

The Division of Educational Relations, with Dr. Vernon Kellogg as chairman, in the National Research Council, has made a special project of this problem of the gifted student. It has various committees at work and aims to collect and disseminate information on this subject. I desire to acknowledge my obligation to this Division for inspiration and facilities in the work, but the suggestions I am now about to make are not official; they are purely personal convictions gained in my own experience and observation.

In the proposals I am about to make, I shall scrupulously avoid the recommending of any procedure which shall in the slightest detract from the present actual privileges and oppor-

tunities that the non-gifted student enjoys. Indeed, the whole appeal for the recognition of the individual in education is as much for the good of the non-gifted as for the gifted student. I am speaking here from the point of view of the intellectually gifted; but we all know that these have many weaknesses and that there are many other gifts or talents which supplement intellect and in many instances outweigh it. I shall therefore not tolerate any odious comparisons in terms of superior and inferior, and my appeal for the gifted shall not convey the slightest slur or disparagement of the non-gifted; but the fact is that, in education as in charity, there has been a constant tendency to give the first and most ardent care to the comparatively helpless. To this I would add some thoughtful equalization of interest.

The discovery of the individual and the study of his talents in modern psychology has brought forth a maxim which may well be our educational slogan: *"Keep each student busy at his highest level of achievement in order that he may be successful, happy and good."*

This maxim is so pithy and cogent that we can afford to read it and reread it, accenting in turn each individual word, as every word of it stands for a principle. Thus, we may emphasize in reading, *each, his, highest, achievement, successful, happy* and *good.*

Keep the moron busy at his highest level of achievement and he will be happy, useful and good; institutions have demonstrated that fact. Keep the gifted student in music or art busy at his highest level of achievement and he may become an artist; that has been demonstrated. But science is slow in applying science to its own procedures. The challenge of educational psychology to-day is this: "Keep the gifted student busy at his highest level of achievement and you may find him a delightful comrade, a contributor to the world's store of knowledge, and a vastly greater man than he could ever have been but for your thoughtful consideration."

To act on the application of this principle, I would urge the extension of the following procedures which have all been tried to some extent in various institutions but need to be promoted.

1. *Sectioning classes on the basis of ability.* We may say in very rough and conservative terms that, if we think of a hundred college freshmen, chosen at random, and match the extremes against each other, 5 at one end can do more than 5 times as much as 5 at the other end. The next 5 at one end can do more than 4 times as much as the next 5 at the other end. The next 6 at one end can do more than 3 times as much as the next 6 at the other end. The next 9 at one end can do more than 2 times as much as the next 9 at the other end. This accounts for the highest and lowest quartiles. The differences at the extreme are much larger than here represented because one or two at the upper end may be capable of rendering more than ten times the *average* output for the class, while the one or two at the other extremes are quite certain to fail. If, then, we seek for a practical basis for the sectioning of classes, we shall do well to recognize three levels which we may call the *high,* the *middle,* and the *low,* the middle being as large as the other two together.

All too often our educational system is based upon the assumption that, where the great Creator failed to make all human beings equal, it is the business of the school to make them equal. To justify this procedure, the school men have found cover in the argument that this task works toward a democratic ideal; that it represents the rights of individuals; that it is necessary for the successful operation of educational machinery; that it is good for the lowly individual; that the procedure is justified by results. Each of these defenses represents a fundamental error and misconception of fact in educational procedure.

The democratic ideal in education, as everywhere else in life, is not identical opportunity for all, but equal opportunity in proportion to capacity. The genius and the moron do not have quantitatively the same rights to knowledge; they have equal rights in proportion to their relevant capacities (quantitative and qualitative), and one should be as insistent upon his rights as the other.

Among the advantages of such sectioning we

may note the following: it becomes possible to apply in teaching the pedagogical maxim, "Keep each student at his highest level of achievement." This will result in the setting up of fair standards for quantity, quality, content, and method of work adapted to a fairly homogeneous group. This in turn will establish a fair basis for praise and blame. The introduction of fair standards of achievement creates morale in a class. There will therefore be a larger output at all three levels; for such grouping is as advantageous to the untalented student as to the talented. Such progressive segregation is one of the best means of discovering and motivating the gifted student; because he is thrown into vital and effective competition, works at his highest level of achievement, and enjoys freedom for initiative in self-expression, and these associations are likely to awaken in him desire for progress, a sense of joy in achievement, and a feeling of fellowship. The introduction of this method, if properly managed, will not increase the cost of instruction, but may reduce it.[2] I have pointed out in two articles on this topic[3] that there is no insuperable difficulty in the way of conflict of hours and cooperation of staff and that every institution that has given the method a fair trial is continuing it.

2. *Honor courses.* Let each department in which there are progressive teachers set out one or more courses to which admission may be gained only upon evidence of fitness. The principal factor to take into account should be high scholarship, or creative achievement, or both together with health. The standard for passing should be much higher than in an ordinary course. The class may well be socialized and the work so arranged as to challenge the individual to wide reading, verification and defense of his findings, experiment, independent thinking and self-expression. Under no circumstances should the course be limited to lecture or textbook; nor should formal essays or papers be read by the student. It should not furnish an opportunity for the instructor to recite the findings of his researches, although the subject of study will most profitably lie within or around his field of research.

Admission to these courses should be in the hands of a scholarship committee to which recommendation for admission and reports of achievement should be made by teachers. Assuming as a unit of credit three year hours; *i.e.,* six semester hours, the exceptional student might be permitted to take one course in the sophomore year, two in the junior year and three in the senior year, but not more than one course of this kind each year in a given department. Thus the amount of credit in such courses might furnish a better basis for designing honor students for graduation than the present basis of mere credits in ordinary courses. The existence of such courses would act as a stimulus to the gifted student who might otherwise be disposed to loaf. Dozens of varieties of honor courses are being tried in different institutions. This plan has the advantage of flexibility, simplicity of administration and a salable proposition to the student.

3. *Individual work.* Shall the freshman who has read current literature and history extensively and lives in it be forced to ruminate the cud of predigested pellets which form the diet of freshman general history? Shall the gifted student, who, given the freedom of the library, can read up in one half to one fifth the time what is doped out in lectures on special topics, be forced to acquire a specialized knowledge in that specific form and at that set pace? Shall the student who, if given free hands, could pass all college examinations required in a year or two be required to mark time for four years? Or, granted that it is good for him to be in college for four years, shall his horizon be limited to the scope of course units? Shall the gifted student who can learn the two hour assignments in science or history or language in fifteen minutes be encouraged to loaf or play the rest of the time? Or shall he be given a different assignment? Shall the gifted student who can do independent work in li-

[2] I am, of course, speaking of the larger institutions; indeed, the very necessity for differentiating students may prove to be a decided disadvantage to the small college.

[3] In *School and Society.*

brary, laboratory, field, or creative work have his progress restricted by course units?

Such questions are all the more pertinent here to-day because American institutions have answered them in a different way from that in which they have been answered by the older institutions in Europe. The American college coddles the student; laces him into a strait-jacket of forms, and spanks or rewards him somewhat in proportion to his conformity to this corset. Professors talk about academic freedom. Perhaps it is time that we heard from the student about academic freedom.

One wholesome practice is to excuse students from too elementary courses and give them more advanced work. But in many cases there should be another outlet. Students who, on admission or later, give evidence of high capacity for achievement should, on recommendation to the department and approval by the scholarship committee, be permitted to register for individual work as a substitute for required courses, work to be counted for credit as in the course. But the standard of passing should be much higher than for the class work (1) to prevent rush to this privilege, (2) to call for high achievement on the part of a gifted student, and (3) to allow for the effect of cramming. The test should, however, be more plastic and personal than the formal tests on course content. In addition to scholarship, admission to such registration should be based upon evidence of fitness for such independent work. The principle of this type of registration once approved by the faculty, the administration of it should be left largely to the departments, so as to make it simple and flexible.

Departments might find it possible to have syllabi, bibliographies and study hints available as an invitation to individual work. Occasional interviews should be granted, but not for the purpose of telling or teaching. In certain subjects each individual's work might be so motivated and organized as to carry a considerable number of students in this way rather than in class, and thereby lighten the burden of teaching. Departments might also go so far as to recognize voluntary groups of two or more students for cooperative study in preparation for such tests as the department might set. In every case, the student would have the advantage of working at the highest level of achievement, would be free from the lock-step of the class room, free from the burden of being bombarded with matters which he already knows. Mathematics, history, government and psychology would be good examples of subjects to pursue in this manner. Mathematics is peculiarly a personal affair; it is a skill which the teacher can not impart. In foreign language there is no reason why a gifted student should spend two years in the class room in learning to read French and German; but if he is given time and realizes what it is for, he can read French or German literature and science and live in it and use it to best advantage and thereby lay a better foundation than he could by merely taking a course. Even laboratory courses might well be mastered in this way. Only gifted students can profit by this privilege. Inferior, mediocre or average students need to be nursed and coddled by the methods we now employ for all. The privilege is merely an honest recognition of the fact that there are some who can learn for themselves, without tutor, lecturer or class whip.

4. *Early contact with mature teachers.* Recently, a faculty committee in a university brought in a report representing essentially this: (1) that elementary students should be taught in sections not to exceed twenty-five; (2) that elementary students should be taught by the mature men in the department; (3) that the teaching schedule for these men should be reduced in order that they may have time for research; and (4) that salaries should be raised. One member of that committee, representing a very large department, was asked to prepare a budget for his department embodying these recommendations. Nothing more has been heard of the report. It simply can't be done.

With the present influx of students, there is a tendency to reserve the most inspiring men for the most advanced courses and leave lower courses in the hands of cheap labor. This is especially demoralizing to the gifted student. When a department has from two to fifty sec-

tions in the elementary subject it can afford to so organize the course that the academically mature and successful man is made responsible for the content and method and meets every student in that course at least once a week. This will probably of necessity involve the combination of the meeting of the class in large divisions for lectures, demonstrations, or formal exercises under mature men and personal work with the students in small sections under younger men.

Let me hasten to say that this must not be confounded with the old-fashioned lecture plan with quiz sections; that plan is dead, or should be. But that should not condemn the meeting of the class part of the time in large divisions and part of the time in small sections. Harvard was one of the worst sinners under the old lecture and quiz systems. But to-day Harvard is in some departments setting a model for this type of organization which insures inspiration and thoroughness in the work. The sophomore in economics, *e.g.*, may work under such men as Taussig, Carver, Burbank, Ripley and Day in a single course and carries away something which stays by him through life. The professor in charge of the course himself carries one section made up of the most gifted students.

The plan I commend on the basis of my own experience is to recognize three needs of instruction: (1) inspiration, motivation, and organization of the work; (2) systematic reading, practical exercises, or experiments; (3) self-expression. The first can be achieved in divisions of from one to five hundred by capable men; the third must be done in small sections; and the second may be directed either from the large division or the small section. The first can be done only by a relatively mature teacher who has marked ability in leadership and the power of address. The third may be done by well-selected, young teachers; the second should represent the ingenuity of the mature teacher and the capacity for routine and detail of the young man.

The organization and conduct of the large division work may be in the hands of one man. But where there are distinct divisions in a department, as in economics, sociology, botany, or psychology, the first year course should be a cooperative affair. There is no need or justification for electives toward a first year course in a department. There should be only one economics 1, one American history 1, one botany 1; for the majority of students take only one course in the department and a course of the second level may well be built upon the general orientation gained in a general survey course. The finest and most extreme embodiment of this principle is perhaps the course in contemporary civilization—a five-hour course required of freshmen in Columbia University.[4]

5. *Time.* There are a number of things that may be done for the gifted student which can not be prescribed but may be included in the general faculty policy of liberality toward the few students who give unmistakable evidence of exceptional achievement. One of these factors is time.

In discussing the gifted student problem, a professor who spoke with a German brogue said, "Vot do ve professors vant? Ve vant time. Vot does the gifted student vant? He vants time." And he was right. The gifted student wants time to pursue his ideal; and he can best get that by some generous policy of exemption from formal training. This comes hard. I well remember what precious hours our faculty wasted in trying to keep Mr. Steffanson, the now famous explorer, from submitting the evidence showing that he could acquire on short notice those units of learning which we have so logically prescribed in our four year course, all of which he could have met in a year or two while he was doing some creative work on the side. (As a matter of fact he did get permission to do that very thing and succeeded.).

This sounds like iconoclasm. It disturbs the dean and the registrar and the professor. As a practical administrator I am not calling for any great or sudden revolutionary procedure;

[4] The October number of the *Bulletin* of the Association of American University Professors contains valuable material on "Initiatory Courses for Freshmen."

but I should like to enter a plea for the recognition of opportunity for reasonable treatment of the gifted student commensurate with his exceptional powers; and one of the conditions for achievement is leisure and the privilege of working at your own pace.

To the now traditional practice of allowing excess registration in proportion to quality of credit should be added the proviso that an excess schedule must include an honor course each year, and general health and social orientation should be taken into account. If this is done, the student may combine the saving of time with the winning of distinction—a type of distinction which has real value. A flexible scale of excess registration may then safely have such range that the very gifted student could complete the college course in three years if he so desired.

Comradeship. The first and greatest need of the gifted student is comradeship or fellowship in the late adolescent pursuit of his ideal if it be the search for truth. Each of us who has had any degree of success in original work can look back to little incidents where a teacher or a more advanced fellow student conveyed the sentiment; you are good enough to be in my company; see with me this vision; share with me this harvest; let us seek truth first hand; I want you to fall in love with my problem; over the mountain top there is light. This can not be achieved through any formal academic procedure. Probably less than one fourth of the college teachers in the United States are capable of participating in this privilege, and yet the principle needs to be urged upon the academic community in order that those who have this interest at heart may not trust the machinery to do what it can not do; may not underestimate the great significance of little things in this direction, or may not in the interest of modesty or academic courtesy hesitate to exercise this privilege. It is a personal affair and must therefore take the course of natural, personal values, privileges, and rewards, given freely for the love of it, living for it as a father lives for his son.

For this reason, formal academic privileges and procedures can not be prescribed or even enumerated. Comradeship must be personal and warm, involving privilege. But the outward organizations must not be ignored. Invitation to the home; participation in small groups, clubs, and societies; the enjoyment of special laboratory and library privileges; the exemption from hampering formalities; the encouragement of rewards of all kinds; the stimulation of competition; the organization of rigorous academic wrangling and criticism; the participation in the reading of manuscripts, the conduct of experiments, scientific expeditions, and learned societies. These things are all of very great value to the student who has been taken into comradeship for research as a neophyte. They come to him because he has been admitted to comradeship and in return he gives his best.

He needs counsel to curb his enthusiasms, to acquire fundamental habits and knowledge, to lay good foundations through training in the fundamentals, to fit himself into the social body in which he lives, to care for his health and manners, to seek reasonable outlet for his ingenuity, to keep from being a hermit or a prig, to keep in the humble attitude of a master who is not puffed up over his achievement.

C. E. SEASHORE
STATE UNIVERSITY OF IOWA

WHAT SHALL BE TAUGHT IN THE FIRST YEAR OF COLLEGE CHEMISTRY?[1]

THERE is much uncertainty among college chemists as to the proper treatment of freshmen, some of whom had chemistry in high school, while some did not. With a class not exceeding one hundred and a somewhat limited teaching staff, there is no better method than to put them all in the same class with the same text. No apology need be offered for such a procedure. In such small classes the teacher can keep in close touch with the individual student and vary the program to suit individual possibilities. This is especially easy in the laboratory drill where the experiments may be

[1] Paper presented at the Pittsburgh meeting of the American Chemical Society.

selected to fit the student's preparation and ability.

In larger institutions, it is more satisfactory to group those with no previous training in a separate class. It is to be hoped they had high school physics as a scientific foundation. General chemistry for such a class should be just what the name implies—a general treatment including traditional descriptive chemistry, physical, industrial, organic, analytical and something of the historical development. Above all, even above the accumulation of facts, this course should give training in real scientific thinking.

This seems like a large undertaking, but it merely means that we take the student up on a high mountain and show him the promised land. The fact that the majority of this class will never study any more chemistry is added reason for a proper breadth of treatment.

The problem is more difficult for students who may possibly feel satisfied with their knowledge of high school chemistry. They enter college to be stimulated and it is fatal to let them feel that college general chemistry has but little in the way of novelty for them. Hence I counsel against a mere hasty review for one semester by way of transition to some advanced course. Such "rush" courses are deadly, dull and unsatisfactory to teacher and pupil. Nothing short of a full year of rather stiff general chemistry will serve the needs of this class and it can be taught with all the freshness needed to whet jaded intellectual appetites.

The high school course was good discipline. It furnished much useful information and inspired the student with a liking for chemistry. It is no reflection on high school teaching to insist that under no circumstances shall a year of college general chemistry be omitted. The explanation is found in the immaturity of the student, the high school environment and the lack of time given to the course.

The college course must cover again the same ground—and much more. It need not, however, be a dull rehash. The broader general chemistry in college must present more fundamental views. Much more of physical chemistry, more exact quantitative experiments, and a glimpse of the newer developments such as radioactivity, atomic structure and colloids are a proper part of such a course. A very simple but reasonably complete system of qualitative analysis may well be used as the laboratory drill during the second semester. This teaches system, classification and comparison. The student greatly enjoys his quest of the unknown and sees a definite use for a somewhat confusing array of facts he may have accumulated. That majority who never take advanced chemistry have a right to the joys and benefits of qualitative analysis.

During this difficult freshman year the old facts of high school chemistry must be dealt with in an interpretative spirit. When taken behind the scenes, so to speak, the student sees a new meaning in the subject. There is small doubt that unless all that has gone before, more or less loosely held in mind, is worked over into a solid foundation the student is chemically crippled for life. A certain amount of forceful repetition is the essence of good teaching. Even in the second, third and fourth years, we all find it profitable to repeat and expand what was presented in the freshman year of general chemistry. This makes the thorough chemist.

It may be well to mention a number of specific topics to be stressed for the class.

The historical development of the system of molecular and atomic weights is far more convincing to the student than a mere statement of the system as it now is. In fact a little of the historical introduction to many topics interests the class and develops the research attitude of mind. It may seem absolutely ridiculous to talk of research on the part of a freshman, yet clever questioning as the steps of a historical piece of research are discussed will do much in stimulating the student into a research attitude of mind.

Structural formulas appal the class on first sight. Later familiarity breeds, not contempt, but appreciation. The usual confusion of formulas of nitrogen, arsenic, antimony and phosphorus compounds is easily cleared up by

constant use of structural formulas. With such practise the study of two chapters of organic chemistry is not appalling.

A library shelf, easily accessible and especially selected for students of general chemistry, pays goods dividends. Other texts, books on the applications and special advertising pamphlets should fill this shelf. Not all will read but those who do are the ones who take advanced chemistry.

Stress must be placed on equilibrium, early and late, on solutions, on that fascinating chapter about the periodic system, on the hydrocarbons and their derivations and such other topics as appeal strongly to the teacher.

* * * * * *

An informal talk with each student or a written test on entrance will indicate that some who have had high school chemistry will do better in the class with those who had none. Since high schools vary widely in quality of instruction in chemistry (as do colleges also) the mere name of preparatory chemistry should not be accepted without some investigation. Usually the record of the school is sufficient evidence.

HARRY N. HOLMES

OBERLIN COLLEGE,
OBERLIN, OHIO

ON THE EXISTENCE OF A HITHERTO UNRECOGNIZED DIETARY FACTOR ESSENTIAL FOR REPRODUCTION[1]

THE fact has been abundantly demonstrated that rats may be reared on a dietary regime consisting of "purified" protein, fat and carbohydrate to which an appropriate salt mixture and adequate doses of the growth vitamines Fat Soluble A and Water Soluble B have been added. We have employed a ration of casein (18), cornstarch (54) and lard (15) to which butterfat (9) and salts (4) are added, the animals receiving separately and daily .4 gram each of dried whole yeast.

Such animals are sterile. They are chiefly so in the first generation and wholly so in the next succeeding one. The sterility of dietary origin yields a highly characteristic picture. Animals suffering from it do not differ so profoundly from normal ones in their ovarian function as they do in placental behavior. Approximately the same number of Graafian follicles mature and rupture per ovulation and the ova are fertilized and implanted. The placentæ are abnormal. They may persist almost throughout gestation but show as early as the second day of their establishment beginning blood extravasations which increase in extent. Resorption invariably overtakes the products of conception.

Natural foodstuffs contain a substance, *X*, which prevents such a sterility or which cures the disorder occasioned by the purified dietary regime. We have thus been able to witness a comparatively sudden restoration of fertility to animals of proven sterility, and whose controls continued sterile, by the administration of fresh green leaves of lettuce. Even the dried leaves of alfalfa appear to possess a similar potency. The proven efficacy of leaves invites inquiry into the certainty of segregation of the new dietary factor from vitamines A and C. As regards A, it is conceivable that amounts of A adequate for normal growth, freedom from eye disease and, indeed, vigorous health might still be inadequate for the reproductive function. Such a conception is apparently strengthened by the reappearance of fertility which we have discovered to take place when the butterfat quota in the above diet is increased so as to constitute 24 per cent. by weight.[2] A sufficient answer to this conception, however, is afforded by our demonstration that in some dietaries reproduction may be unhindered when the A content is lower than in

[1] University of California, aided by the Dairy Division of the Bureau of Animal Industry of the United States Department of Agriculture, the Committee for Research on Sex Problems of the National Research Council and the California Central Creameries. The writers desire also to express their especial thanks to Mr. C. E. Gray, of San Francisco, and Dr. C. W. Larson, of Washington.

[2] Drummond (*Biochem. Jour.*, xiii, 77) has, for instance, reported two generations of animals reared on 20 per cent. butter in this diet.

our ration. Such a diet is furnished by rolled oats (40), gelatin (10), casein (5), dextrin (40.3), butterfat (1), and salts (3.7) (McCollum). It is perhaps also pertinent to point out that we have detected an invariable sign of inadequacy in the A factor of greater delicacy than those hitherto employed and may thus recognize such inadequacy long before growth impairment, for instance. The sign is constituted by a highly characteristic aberration of the œstrous cycle. And we have been able to demonstrate the persistence of fertility with a wheat-milk ration (Sherman) even in the absence of butterfat and when the A deficiency is heralded by the continuous exhibition of the new sign. The beneficial effect of a very high percentage of butterfat, consequently, seems preferably explained by its possession of a definite though low quota of the fertility conferring substance. Furthermore, a sample of cod liver oil tested by us and proven to possess a much superior A content to butterfat is far less efficacious than butter in curing or preventing the impairment of the reproductive function.

The beneficial dietary factor can not be identical with the antiscorbutic vitamine C, for curative effects have been secured when ground whole wheat was added to our purified ration, and the cereals are, of course, notably deficient in C. Moreover, although some favorable influence on growth has been noted, it has been impossible for us to secure with orange juice the fertility effects so evident with lettuce.

Lastly, we may refer to the suggestions either implied or expressed in the publications of some investigators (Osborne and Mendel, Kennedy and Palmer) that yeast contains some toxic substance inimical to the organs of generation and hence causing sterility or that it simply does not contain enough of the water soluble vitamine B. The curative foods could hardly be assumed to detoxify. Nor do we believe our animals suffered from lack of B, for growth was excellent; and as much as 25 per cent. by weight of yeast (which must have given a great surplus of B) did not change the result. Fertility, when wheat germ is used as a source for B, results not from more B but because wheat germ is also rich in X.

We have undertaken a series of experiments designed to trace further in natural foods the distribution of the substance thus shown to be indispensable for the production of healthy young.

HERBERT M. EVANS
K. SCOTT BISHOP

THE RECENT SCIENTIFIC WORK OF ROBERT WHEELER WILLSON

IT must be of interest to the many friends and former students of Professor Robert W. Willson to know that the last months of his life were actively occupied in the successful solution of certain scientific problems.

Professor Willson died at his home in Cambridge, November 1, 1922, in the seventieth year of his age. He was a graduate of Harvard College in the class of 1873, and took his Ph.D. at Würzburg a few years later, after specializing in physics, a subject which, in conjunction with his astronomical experience, gave just the right equipment for his solution of aerial navigation problems at a much later date.

The main facts of his professional career are available in the biographical reference books, while others can speak more fully than I of his devotion to the building up of a department of astronomy in Harvard College. Following his retirement as professor emeritus in 1919, he devoted an increasing amount of time to his own work in Cambridge along the line of air navigation instruments, and this later work is not perhaps so well known.

His development of the air-craft sextant was a notable achievement successfully demonstrated during the war, and widely adopted since. Anti-aircraft defense, trans-Atlantic flight, and ground speed indicators were only a few of the subjects which claimed his keenest attention and in which definite progress had been made. He was fully aware of all the trying obstacles which must be met in the development of instruments for practical airplane use, and not only had a sound, scientific solution in readiness for each case, but was equally alert to suggest the most economical method of construction.

Some of this material had been prepared for publication in the form of a paper on Air Navigation and sent to press early in October, following which his attention was eagerly concentrated on further problems. So the end came like a ship holding its course accurately, and passing out of sight with all sails set.

M. H. D.

PITTSBURGH, PA.
NOVEMBER 6, 1922

SCIENTIFIC EVENTS

MORTALITY FROM CANCER

THE Department of Commerce announces that the returns compiled by the Bureau of the Census show that over 76,000 deaths were due to cancer in the death registration area of the United States in 1921, and assuming that the rest of the United States had as many deaths from this cause in proportion to the population, the total number of deaths from cancer in the entire United States for 1921 was 93,000, while for 1920 the number is estimated as 89,000 or 4,000 less than for 1921.

The trend of the cancer death rate is upward, the rate for 1921 being higher than that for any earlier year in twenty-three of the thirty-four states. The cancer death rate in the registration area in 1921 was 86 per 100,000 population, against 83.4 for 1920. In comparing the death rate from cancer in one state with that in another, the bureau uses "adjusted" rates in order to make allowance for differences in the age and the sex distribution of the population, because, generally speaking, only persons in middle life and old age have cancer, so that a state with many old persons may be expected to have more deaths from cancer than a state with comparatively few old persons.

The highest "adjusted" cancer rate for 1921 is 99.6 per 100,000 population for the state of Massachusetts, and the lowest is 47.6 for the state of South Carolina. For a few states adjusted rates have been calculated separately for the white and colored population. In this group of states the highest adjusted cancer rate for the white population is 95.9 per 100,000 population for New York and the highest rate for the colored population is 90.6, also for New York. The lowest adjusted cancer rate for the white population is 51.5 for Tennessee and the lowest for the colored population is 36.4 for Florida.

The adjusted rates show that the northern states have comparatively high and the southern states comparatively low cancer mortality, while there is little difference between the adjusted cancer rates of the white and colored races of the same states.

COLORS FOR TRAFFIC SIGNALS

THIRTY-NINE men, representing as many administrative bodies, trade associations, scientific or technical societies, and government departments, make up the sectional committee on colors for traffic signals which was organized at a meeting in New York City on November 9 under the auspices of the American Engineering Standards Committee. In opening the meeting, P. G. Agnew, secretary of the American Engineering Standards Committee, said that this was unquestionably the most representative group that has ever come together anywhere in the world to discuss this subject.

The committee elected as its officers the following representatives of the three sponsors for the code: *Chairman,* Charles J. Bennett, state highway commissioner of Connecticut, representing the American Association of State Highway Officials; *vice-chairman,* Dr. M. G. Lloyd, representing the United States Bureau of Standards; *secretary,* Walter S. Paine, research engineer, Ætna Insurance Company, Hartford, Conn., representing the National Safety Council.

Because of the difficulty of bringing the entire sectional committee together at frequent intervals an executive committee was appointed with instructions to collect information on the subjects coming within the scope of the code, to digest this information, to appoint subcommittees, to arrange for the necessary research work, and to draft definite recommendations for the consideration of the sectional committee. The executive committee consists of the following:

Bert Lord, New York State Department of Motor Vehicles, Albany, N. Y., representing the group of administrative officials and departments;

T. D. Pratt, Motor Truck Association, New York City, representing the owners and operators of motor vehicles;

G. G. Kelcey, American Gas Accumulator Company, Newark, N. J., representing the group of automotive accessory, signs and signal manufacturers;

A. H. Rudd, Safety Section, American Railway Association, representing the railroads;

W. P. Young, general manager, National Automobile Underwriters Conference, representing the group of insurance interests on the sectional committee;

W. P. Eno, of the Eno Foundation, Washington, D. C., representing the group of scientific and technical societies;

Harry Meixell, of the Motor Vehicle Conference Committee, New York City, representing the motor vehicle manufacturers;

and the three officers of the sectional committee.

The sectional committee by resolution invited the Aeronautical Chamber of Commerce of the United States to participate in the work of the committee. It was also decided at the organization meeting of the sectional committee to appoint a sub-committee to investigate the efficiency of all color signals now in use as traffic signals, and where possible to ascertain the reasons for adopting certain colors for specific uses. This committee will investigate the use of various types of semaphores and silent policemen. Another committee will make an original study of specific colors for definite uses as a check upon previous researches and to establish certain colors for traffic signals. A third committee will study non-luminous signs and signals and propose, after thorough research, signs of definite colors and shapes for highways and also for railroad crossings.

THE CHARLES A. COFFIN FOUNDATION

ON May 16, 1922, Mr. Charles A. Coffin, in his seventy-eighth year, retired from the active leadership of the General Electric Company. Mr. Coffin has been identified with the development of the electrical industry since 1882. He was the founder and creator of the General Electric Company, of which he has been the inspiration and leader for thirty years. As an expression of appreciation of Mr. Coffin's great work not only for the General Electric Company but also for the entire electrical industry and with the desire to make this appreciation enduring and constructive as Mr. Coffin's life and work have been, the board of directors of the General Electric Company created on his retirement and now desire to announce the "Charles A. Coffin Foundation."

A fund of $400,000, to be known as the "Charles A. Coffin Foundation," has been set aside and the income, amounting to approximately $20,000 per year, will be available for encouraging and rewarding service in the electrical field by giving prizes to its employees, recognition to lighting, power and railway companies for improvement in service to the public and fellowships to graduate students and funds for research work at technical schools and colleges. The foundation will be controlled and administered by a foundation committee appointed by the board. This committee, within the limits of the purposes for which the foundation is created, will have power to change the conditions applicable to the distribution of the fund and the amounts for each particular purpose.

The committee proposes to distribute the income of the foundation as follows:

First. Eleven thousand dollars ($11,000) in prizes for the most signal contributions by employees of the General Electric Company toward the increase of its efficiency or progress in the electrical art. Particularly, the prizes are to further encourage suggestions from workmen. With each prize, the company will give a certificate of award.

Second. A gold medal, to be known as the "Charles A. Coffin Medal," will be awarded annually to the public utility operating company within the United States which, during the year, has made the greatest contribution towards increasing the advantages of the use of electric light and power for the convenience and well-being of the public and the benefit of the industry. The company receiving the medal will also receive one thousand ($1,000) for its employees' benefit or similar fund.

Third. A gold medal, to be known as the "Charles A. Coffin Medal," will be awarded annually to the electric railway company within the United States which, during the year, has made the greatest contribution towards increasing the advantages of electric transportation for the convenience and well-being of the public and the benefit of the industry. The company receiving the medal will also receive one thousand dollars ($1,000) for its employees' benefit or similar fund.

Fourth. Five thousand dollars ($5,000) is to be awarded annually for fellowships to graduates of American colleges and technical schools who, by the character of their work, and on the recommendation of the faculty of the institution where they have studied, could with advantage continue their research work either here or abroad; or some portion or all of the fund may be used to further the research work at any of the colleges or technical schools in the United States. The fields in which these fellowships and funds for research work are to be awarded are: Electricity; physics; physical chemistry.

A committee appointed by the foundation committee will award such fellowships and funds for research work, with the advice and cooperation of a committee of three, one to be appointed by each of the following: The National Academy of Sciences, the American Institute of Electrical Engineers and the Society for the Promotion of Engineering Education. This committee is to be known as the "Charles A. Coffin Fellowship and Research Fund Committee" and the fellowships are to be known as the "Charles A. Coffin Fellowships."

The board of directors of the General Electric Company has appointed as the "Charles A. Coffin Foundation Committee" the following officers of the company: A. W. Burchard, J. R. Lovejoy, E. W. Rice, Jr., Gerard Swope and O. D. Young.

The following committee, to administer the fund and to act with organizations outside the company, have been appointed:

Committee to cooperate with the National Electric Light Association: A. H. Jackson, J. R. Lovejoy, vice-presidents.

Committee to cooperate with the American Electric Railway Association: J. G. Barry and A. H. Jackson, vice-presidents.

Committee to cooperate with the National Academy of Sciences, American Institute of Electrical Engineers and the Society for the Promotion of Engineering Education: E. W. Rice, Jr., honorary chairman, A. H. Jackson, vice-president, and W. R. Whitney, director of research laboratory.

THE SOCIETY OF SIGMA XI

THE annual convention of the Society of the Sigma Xi will be held in Cambridge on December 27, at the time of the meetings of the American Association for the Advancement of Science. The program of the convention includes the following:

2:30 P.M. Business session.

6:15 P.M. Annual dinner.

8:45 P.M. Joint meeting with the American Association for the Advancement of Science. Address, "The Nation and its Health," by President Farrand of Cornell University.

The chapters of Sigma Xi are entitled to delegates with the right to vote at the business session. Attendance at the business session or the dinner or the evening address is not limited to delegates. All members of the society are invited to be present and will be welcome at all the meetings. A special desk for the registration of members of Sigma Xi will be provided in the registration bureau of the association, where programs and dinner tickets may be secured. Clerks will be in attendance at this registration desk on December 26 and 27.

The business session of the convention will be one of unusual importance, since a complete revision of the constitution of the society is to be brought up for adoption. The revision has been made necessary by the growth of the society as well as by the expansion of its work. Sigma Xi is no longer a society of a few chapters scattered among the educational institutions of the country, but it is a large organization numbering thirty-eight chapters in universities and in some of the research institutions of the country. In addition to this active membership there are scattered over the country and the world some fifteen thousand members of Sigma Xi, who by the provisions of the new constitution will be brought into closer touch with the work of the society. All

members of Sigma Xi, whether delegates from chapters or not, are invited and urged to take this occasion to get acquainted with the new spirit in the organization.

SCIENTIFIC NOTES AND NEWS

THE Lalande Medal of the Paris Academy of Sciences has been awarded to Dr. Henry Norris Russell, director of the Princeton Observatory. The Janssen Medal goes to Dr. Carl Stormer, professor of pure mathematics at the University of Christiana, for his work on the aurora borealis.

DR. SIMON FLEXNER, director of the Rockefeller Institute for Medical Research, New York, was elected an honorary member of the Copenhagen Medical Society at a recent meeting celebrating the one hundred and fiftieth anniversary of that body.

AT a general meeting of the Royal Scottish Geographical Society, held on November 7, the society's gold medal was awarded to Professor J. W. Gregory, University of Glasgow, in recognition of the scientific importance of results obtained by him through explorations in Spitsbergen, Australia, East Africa and southwest China.

DR. J. BORDET, professor of bacteriology at Brussels, has been given an honorary degree by the University of Paris.

DR. H. J. KAMMERLINGH ONNES, of the University of Leiden, celebrated on November 11 the completion of his fortieth year of service as professor of physics.

A BANQUET was tendered Dr. Calleja, professor of histology at the University of Madrid, on the occasion of his fiftieth professional anniversary.

DR. JOHN W. HARSHBERGER, professor of botany at the University of Pennsylvania, has been made a member of the Swedish Linnæan Society and of the Finnish Forestry Society.

DR. F. W. PEABODY, of Boston, professor of medicine at the Medical School of Harvard University, and physician-in-chief of the Boston City Hospital, has been elected a member of the Council on Pharmacy and Chemistry to fill the vacancy caused by the resignation of Dr. C. L. Alsberg, formerly chief of the Bureau of Chemistry, Department of Agriculture, and now director of the Food Research Institute of Stanford University.

DR. KENYON L. BUTTERFIELD, president of the Massachusetts Agricultural College, has been reelected president of the American Country Life Association for 1922-23. C. J. Galpin, of the U. S. Department of Agriculture, is first vice-president.

THE British Institution of Civil Engineers has made the following awards for papers printed in the *Proceedings* for the session 1921-1922: A George Stephenson gold medal to Dr. B. C. Laws (London); Telford premiums to Professor L. Bairstow (London), Dr. A. J. Sutton Pippard (London), Mr. E. A. Cullen (Brisbane), Mr. H. H. Dare (Roseville, N. S. W.), and Mr. F. W. Stephen (Aberdeen). For papers read before meetings of students in London and the provinces the following awards have been made: A Miller prize and the James Forrest medal to Mr. F. H. Bullock (Cardiff); and Miller prizes to Mr. J. G. Mitchell (London), Mr. A. G. M'Donald (London) and Mr. Harry Wolf (Manchester).

PROFESSOR E. W. BROWN, of Yale University, will be absent from New Haven until April, 1923. His address will be care of the Bishop Museum, Honolulu, H. I.

DR. R. S. BREED, chief in research (bacteriology) at the New York State Agricultural Station, has been granted six months' leave of absence beginning on March 1, 1923, for the purpose of special study of bacteriological problems at the Pasteur Institute and of dairy sanitation in France, Denmark and Holland.

DR. LOUIS I. DUBLIN, statistician of the Metropolitan Life Insurance Company, will deliver the third Harvey Society Lecture at the New York Academy of Medicine, on Saturday evening, December 16, 1922. His subject will be "The Possibilities of Human Life."

AT the November meeting of the Society of the Sigma Xi of the University of Wiscon-

sin, Professor Louis Kahlenberg, of the department of chemistry, delivered the address on the subject, "The separation of crystalloids from one another by dialysis."

PROFESSOR CASSIUS J. KEYSER delivered an address on the "Mathematical obligations of philosophy and education" at the weekly convocation of Connecticut College on November 14. On December 2 he gave an address on "Mathematics and man" at the meeting of the Association of Teachers of Mathematics of the Middle States and Maryland held at Wilmington, Del.

A STATUE of Claude Louis Berthollet, the French chemist, has been erected at his birthplace, Annecy, on the occasion of the centenary of his death on November 6, 1822.

DR. ALBERT HENRY BUCK, from 1887 to 1904 professor of otology in Columbia University, a leading aurist in New York City, died on November 16, in his eighty-first year.

DR. OSCAR HERTWIG, director of the Institute of Histology at the University of Berlin, died on October 27, aged seventy-three years.

THE death is announced of Dr. Lassar-Cohn, since 1894 professor of chemistry at Königsberg.

MR. JAMES A. TEIT, well known for his researches on the ethnology of British Columbia, died on October 30 at Merrit, British Columbia. Mr. Teit carried on researches in connection with the work of the Jesup North Pacific Expedition of the American Museum of Natural History. He contributed to the work of the Bureau of American Ethnology and to the Anthropological Department of the Geological Survey of Canada. During the last years of his life, Mr. Teit succeeded in organizing the Indians of British Columbia for the purpose of acting collectively in necessary negotiations with the Canadian government relating to questions of land holding, fishing rights and other matters concerning the life of the natives.

PROFESSOR A. V. VASSILIEV, of the University of Petrograd, sends us the following note: "Professor A. A. Markov (1856-1922), emeritus professor of the University of Petrograd, member of the Russian Academy of Science, died at Petrograd on July 27. A mathematician of world-wide reputation, Professor Markov was a graduate of the University of Petrograd, pupil and follower of Chebyshev, Korkin and Zolotarev. The main fields of his investigations were the theory of indefinite binary and ternary quadratic forms and the theory of linear differential equation (hypergeometrical equation). His brilliant achievements brought him at the age of thirty the honor of being elected member of the Russian Academy of Science. His works on the calculus of finite differences and on the theory of probabilities were translated into German and published in 1896 and 1912, respectively."

PROFESSOR VASSILIEV also writes: "Professor L. A. Chugaev (1873-1922) died of typhoid fever at the city of Griazovtzy in the province of Vologda on September 23. One of the most eminent of Russian chemists, Professor Chugaev was a professor in the University of Petrograd, and director of the Institute for the Investigation of Platinum. His various articles on camphor, platinum, cobalt and nickel were published both in Russia (*The Journal* of the Physico-Chemical Society of Russia) and in western Europe (*Journal of the Chemical Society, Zeitschrift für anorganische Chemie,* etc.)."

THE fourteenth annual meeting of the Paleontological Society will be held Thursday to Saturday, December 28 to 30, in the Natural Science Building, University of Michigan. The address of Charles Schuchert, retiring president of the Geological Society of America, will be delivered in the closing hour of the morning session of that society, Thursday, December 28. The address of W. D. Matthew, retiring president of the Paleontological Society, on the subject "Recent progress and trends in vertebrate paleontology" will be given at 2 P.M., Friday, December 29. The members are invited to the annual smoker at 9 P.M. Thursday and the annual dinner at 7 P.M. Friday with the Geological Society of America.

THE Eleventh International Physiological Congress will be held in Edinburgh, from July 23 to July 27, 1923, under the presidency of

Sir Edward Sharpey Schafer, M.D., F.R.S. Those who desire to be enrolled as members are requested to forward their names and addresses, together with the amount of their subscription (25 shillings), to Miss Charlton, Department of Physiology, University, Edinburgh, who will send on request particulars of hotels and lodgings, and all other necessary information.

IN its issue of October 28 *Nature* says: "In an article on Lord Inchcape's task in the *Sunday Times* of October 22, a former finance member of the government of India, Lord Meston, makes an alarming suggestion. Speaking of things 'useful, but not essential,' he says, "many of the research institutes and the like will come under the shears.' The illiberal spirit which inspired our domestic wielders of the axe may thus be carried by one of them to India—a country which, more than any other, perhaps, has benefited by the application of science to 'useful' purposes. The plant breeders there, alone, have literally added millions to the country's wealth; new wheats and cottons yielding 20 to 30 per cent. more than the indigenous varieties have already been successfully introduced. It must not be forgotten that, in India, the prosperity of agriculture is a fundamental element of the solvency of the government, for there, the state, as owner of the soil, takes one half of the rental value of the land. The sum thus raised approaches a moiety of the whole taxation of the country. It is to be hoped that such a suicidal policy as that indicated by Lord Meston will not be advocated by Lord Inchcape, though as a quondam member of the Geddes Committee he may be inclined to repeat its mistakes."

DR. H. M. QUANJER, head of the Institute for Phytopathology at Wageningen, Holland, announces that an international phytopathological conference is being organized to meet in Holland in June, 1923. The committee in charge consists of Professor Westerdijk, Mr. v. Poeteren, and Dr. v. Slogteren in addition to Dr. Quanjer. A cordial invitation is extended to Americans. Detailed announcement may be expected later and meanwhile any inquiries may be addressed to Dr. Quanjer.

THE program for the second annual meeting of the Science Section of the Association of Colleges and Preparatory Schools of the Middle States and Maryland held at the Tower Hill School, Wilmington, Delaware, on Saturday, December 2, 1922, at 9:45 A.M., was as follows: Address on "Science teaching in schools and colleges," Dr. Charles L. Reese, chemical director, E. I. duPont deNemours and Company. Symposium on "Outstanding Problems of the Science Curriculum" (ten-minute papers): "The present status of science in the high schools of New York City," Rosemary F. Mullen, Washington Irving High School, New York City; "The ideal science curriculum for the high school," J. M. Arthur, Tome School, Port Deposit, Md.; "The elective system and the science curriculum in the secondary school," Henry M. Snyder, Wilmington High School; "Biology in the science curriculum," Winifred J. Robinson, dean of Women's College, University of Delaware, Newark, Delaware; "The status of the American Chemical Society on the correlation of high school and college chemistry," Neil E. Gordon, University of Maryland, secretary of Chemical Education Section, American Chemical Society. Address on "The relation between science and modern religious thought, Dr. S. C. Schmucker, professor of biology, State Normal School, West Chester, Pa.

THE University of Paris has published comparative statistics of students matriculated in 1921 and 1922, which are quoted in the *Journal* of the Medical Association. In July, 1921, the total matriculation reached 21,185 (17,993 men and 3,192 women). In 1922 the number had grown to 21,612 (18,066 men and 3,546 women), or an increase of 427 students. The department most strongly represented in 1922 was law. Then came medicine, with 4,639 students (738 women); belles-lettres, with 3,381 students (1,450 women); sciences, with 3,179 students (532 women), and pharmacy, with 743 students (234 women). The department in which the most women are enrolled is that of belles-lettres (1,450 women as against 1,931 men). From 1921 to 1922 the number of

French students at the University of Paris increased by 959, while the number of foreigners decreased by 332.

THE annual report of the general progress of the British Museum and of the Natural History Museum during 1921 has been issued. Notes by Sir F. G. Kenyon and Sir Sidney F. Harmer describe the additions made to the collections and the rearrangement of rooms. During the year 901,209 persons visited the British Museum, of whom 159,177 were reading room students. Visitors to the Natural History collections in Cromwell Road numbered 479,476.

PRELIMINARY announcements by the Australian Research Council indicate the scope of the Pan-Pacific Scientific Congress to be held in Australia in August, 1923. The program calls for organized conferences on fundamental topics in anthropology, agriculture, botany, entomology, geography, geology, geodesy and zoology. Among the discussions in geology formulated by E. C. Andrews are "Relation of coral reefs to glaciation," "Structure of the Pacific," "Mountain building and igneous intrusion," "Carboniferous and Permian stratigraphy" and "Mineral resources of the Pacific." Arrangements are being made for excursions to the desert, to the tropical jungles and to living coral reefs. By request of the Australian committee, headed by Sir T. Edgworth David, the National Research Council, which organized the First Pan-Pacific Scientific Conference at Honolulu in 1920, is cooperating to insure a profitable meeting for 1923.

REPORTS from Commander J. C. Thompson and Hans G. Hornbostel, representing the Bishop Museum, indicate successful outcome of the explorations in Guam and in the southern Marianne Islands. Much information has been obtained regarding the culture of vanished Chamorros, a flourishing race, at the time of Magellan's visit in 1521. Under the direction of M. F. Malcolm, assisted by the governor of Saipan, the remarkable ruins on the Japanese island of Tinian, visited by Anson (1749), Mortimer (1791) and Freycinel (1817), are being studied with a view to enlarging the knowledge of migration routes and inter-relations of Pacific peoples.

HARVARD UNIVERSITY has come into possession of the Farlow botanical library, one of the most valuable collections of books dealing with cryptogamic botany in the world, quarters having been provided for it which meet satisfactorily the conditions of gift contained in the will of Professor William G. Farlow, who died in 1919. Under Prorfessor Farlow's will, this collection, comprising 11,000 volumes, was given to Harvard on condition that, within three years after the testator's death, suitable arrangements should be made for placing it in fireproof quarters in proximity to the Farlow herbarium of cryptogamic plants, already owned by the university. These conditions have been met by the decision of the Harvard Corporation to house both the Farlow library and the herbarium in the Divinity Library building.

THE expedition sent last July by the American Museum of Natural History to the island of Santo Domingo to secure, if possible, specimens of the rhinoceros iguana and the giant tree frog, has returned to New York with a large collection, including over two hundred living specimens in addition to the preserved material. The expedition was financed by the Angelo Heilprin Fund and the materials which it collected will be installed in the museum's new Hall of Reptiles, at present under construction. Under the leadership of Dr. and Mrs. G. Kingsley Noble, both of the museum staff, the party crossed the entire length of the Dominican Republic while pursuing its investigations. After exploring the Quita Espuela, an outlying mountain range in the northeastern part of the island, the expedition crossed to Constanza, in the heart of the central Cordillera. From there it pushed on to Barahona, and finally to Los Lajas on the Haitian border.

THE Sigma Xi Club of Southern California held its first regular meeting in Los Angeles on the evening of October 28. About eighty-six persons were present including members from numerous Southern California towns. Dr. W. L. Hardin, president of the club, presided. Professors R. A. Millikan, C. G. Darwin and Paul Epstein, of the California Institute of Technology, were guests of the club and

were elected honorary members. Professor Millikan told of the activities of the scientific committee of the League of Nations, of which he is a member, and discussed what is desirable in international cooperation in scientific matters. Professor Darwin addressed the club on "The nucleus of the atom." The following officers were elected for the ensuing year: *President,* W. L. Hardin, Mt. Washington, Los Angeles; *vice-president,* L. S. Weatherby, University of Southern California; *secretary,* P. W. Merrill, Mt. Wilson Observatory; *treasurer,* E. E. Chandler, Occidental College.

Nature notes the assignment to science of the proceeds of the first performance of a great play by a leading dramatist. The play was the tragedy "Judith," by M. Henri Bernstein, produced at the Gymnase Théatre, Paris, on October 12, before a brilliant and distinguished assembly, which comprised ministers of state and the chief social and intellectual leaders of the city. The receipts were for the benefit of the French Confederation of Scientific Societies, and amounted to about $5,000. M. Bernstein gave his royalty as author, and Mme. Simone, who took the title part and is said to have obtained the greatest triumph of her career, devoted her fee to the same purpose.

WE learn from the *Journal* of the American Medical Association that the national alliance to promote an increase in population in France is planning a competitive contest with prize awards totaling 120,000 francs for the best essays setting forth the critical demographic situation and the best means of combating the danger. The first prize is 50,000 francs; the second, 10,000 francs; the third, 8,000 francs, while the balance of the 120,000 francs will be distributed in small sums. The essay which is awarded the first prize will be printed by the national alliance and 500,000 copies will be distributed throughout the country. The competitors will deal more especially with the following topics, but they will not be confined to these: (A) The evil as it exists: (1) the decrease of the birth rate in France, during the past century; the inevitable further decrease in the future if the most energetic measures are not adopted, and (2) the dangers that lurk in the fall of the birth rate and the catastrophe that threatens not only the life of the nation but also of the individual. (B) The proposed remedies: (1) the respect due to large families and the advantages that they deserve; (2) the reforms needed to raise the birth rate—at the price of financial sacrifices, if necessary; if by the expenditure of certain sums an increase in the number of births can be brought about, no money could be better expended, and (3) instruction in the matter of the moral, social and patriotic duty of paternity and maternity—their joys and their rewards.

UNIVERSITY AND EDUCATIONAL NOTES

THE University of Pennsylvania will receive $200,000 for the establishment of a department of clinical surgery from the estate of Edmund A. W. Hunter. The bequest was made with the provision that the addition to the university be known as "The Agnew and Hunter Department of Clinical Surgery," in memory of Dr. D. Hayes Agnew and Dr. Charles D. Hunter. The latter was the son of the donor.

A FUND of $60,000 for establishing a chair at Tulane University of tropical diseases and hygiene, and one amounting to $30,000 for constructing an isolation building for the Charity Hospital will eventually be available to these institutions under the will of the late William G. Vincent.

THE trustees of Hamilton College have authorized the erection of a biology-geology and museum building to cost approximately $225,000, and the construction of an addition to the chemistry building the estimated cost of which is $60,000. It may be noted further that the board of trustees, by unanimous vote, with twenty-five of the twenty-eight members of the board present, authorized the fixing of four hundred as the ultimate and maximum number of undergraduates in the college, and directed that all building plans take that number into account as the total for which provision should be made.

RUTH OKEY, Ph.D., has resigned from the biochemical laboratory of the University of

Iowa Hospital, Iowa City, to take up the teaching of nutrition at the University of California.

DR. WILLIAM E. BLATZ has been appointed instructor in psychology at the University of Chicago.

LEOPOLDO B. UICHANCO, Sc.D. (Harvard), has resumed his former work in the University of the Philippines, where he has been appointed assistant professor of entomology at the College of Agriculture, Los Baños, P. I. Dr. Uichanco had been on leave for about three years, as a traveling fellow of the University of the Philippines in the United States, spending the larger portion of this period in post-graduate work at the Bussey Institution of Harvard University.

DISCUSSION AND CORRESPONDENCE

WEATHERING UNDER CONSTANT CONDITIONS

DURING the past summer the writer visited a number of the paleolithic caves of southern France and northern Spain, and there had an opportunity to study the effects of weathering upon rocks and upon the works of man where conditions have apparently remained unchanged during a time which is variously estimated at from 18,000 to 30,000 years.

Every geologist from his own observations and reading can give many examples of rapid weathering, such as that on the western front of the Amiens Cathedral probably not an original stone placed there by the builders in the fifteenth century can be found;[1] that the outside stones of Westminster Abbey have been renewed five times over; that the stone of which the British Houses of Parliament are built has crumbled so rapidly that already it has been necessary to replace many of the stone ornaments with cast iron.

On the other hand, so many objects showing almost no evidence of weathering have been taken from tombs in Egypt where they were buried for many centuries that little surprise was evinced when the Metropolitan Museum Expedition of 1919-1920,[2] announced the discovery at Thebes, in the chamber of the tomb of a man of great wealth, of a large number of remarkably preserved small wooden models illustrating the daily life of his household: brewers making beer, cooks making bread, boats with their boatmen, cattle fattening in their stable. These wooden models, which are "practically as perfect as the day they were made," were carved and stored away about 4,000 years ago, but so little have they been affected by the agents of the weather that even the finger and thumb prints of the men who carried the figures up to the tomb are preserved as well as fly specks on the models and spider-webs with dead spiders still in them.

It is perhaps because of the many archeological discoveries in arid countries that we have become accustomed to think of the agents of the weather as working slowly only where there is little or no moisture, but the wonderfully preserved paintings, engravings and clay models which are to be seen in the moist caves of southern France and northern Spain, and which antedate the works of the Egyptians by thousands of years, compel a modification of these views.

When the polychrome paintings on the ceilings of the great chamber of the cave of Altamira, near Santander, Spain, were discovered, careful observers doubted their authenticity because they showed so little evidence of great antiquity: the paint is so fresh that it can easily be rubbed off with the finger, the colors are probably nearly as bright as when first laid on, and there is no conspicuous flaking of the surface. Notwithstanding their modern appearance it is generally agreed that the paintings were made by paleolithic artists thousands of years before the pyramids were built or Babylon founded.

In the cave of Combarrelles and in other caves in the Dordogne region of southern France the same absence of conspicuous weath-

[1] J. W. Gregory, "Geology of To-day," page 91.

[2] *Bull. Metropolitan Museum of Art*, XV, December, 1920, pp. 12-40.

ering is marked: the only obvious change in the engravings made by paleolithic artists is that the incisions have taken on the buff color of the rock and are no longer white as when first made.

In the cavern of Tuc D'Audoubert on the estate of Count de Begouen, near St. Girons, in the Pyrenees, is an even more remarkable example of lack of disintegration. In this cave are the clay models of bison which are in nearly as perfect condition as when made. A clay model is almost a synonym for the ephemeral for the reason that a short exposure to ordinary air causes it to dry and crack, and excessive moisture causes it to collapse. These models of bison are in fact slightly cracked but with this exception are unchanged. It is possible that the cracks were formed within the first few weeks after the figures were modeled and that none has developed in the 18,000 to 30,000 years that have followed. This seems incredible, but the proof of very great age appears to be well established.

The conditions under which the art of paleolithic man has been preserved almost unchanged for thousands of years are to be found in the uniform temperature, lack of sunlight, and absence of circulating ground water. Although the rock in the Altamira cave is saturated there has been slight movement of the ground water and consequently little solution or deposition has been possible. In the cave of Tuc d'Audoubert there is now some solution and the composition of the water which drips from the roof of the cave has changed slightly as is shown in some of the stalagmites which after being built by lime deposited from the water now have crater-like depressions in their summits showing that the water is at present under-saturated. It is probable, however, that the moisture content of the air has remained constant and that, because of this, the clay models have not disintegrated. The remarkable preservation of the Egyptian wooden models to which reference has been made is due to uniform temperature, lack of sunlight and absence of moisture.

The explanation of such remarkable preservation therefore involves no new principle as it is due to uniform temperature, absence of sunlight, and non-circulation of ground water. These are, indeed, the conditions under which, deep down in the rocks, the skeletons of the vertebrates of the past are preserved.

HERDMAN F. CLELAND

WILLIAMS COLLEGE

[3] Comte de Begouen: "Les Statues d'Argile prehistoriques de la Caverne du Tuc D'Audoubert (Ariège). *Comptes rendus des séances de L'Académie des Inscriptions et Belles Lettres*, 1912, p. 532.

[4] Macallister, R. S.: "A Text-book of European Archæology," Vol. 1, 1921, p. 481.

THE BEGINNINGS OF AMERICAN GEOLOGY

TO THE EDITOR OF SCIENCE: In his letter, "The Beginnings of American Geology" (SCIENCE, October 27, 1922), Dr. Marcus Benjamin (doubtless quite unintentionally) makes a statement which is not only unsupported by facts but which most unjustly reflects upon the character and career of a distinguished American geologist, a president of the Geological Society of America, and also of the American Association for the Advancement of Science, and, I think, the most unselfish, modest and self-effacing man of science I have ever known.

As in these days whatever appears "in print" is likely to become material for the future historian it seems worth while to correct the erroneous statement.

In his reference to Dr. Newberry's connection with the Geological Survey of Ohio there occurs the phrase "owing to the changes in political administration in Ohio he (Newberry) found himself displaced by a subordinate."

Neither of the two statements incorporated in this sentence is true.

No one who had the good fortune to know Dr. Edward Orton, who was Newberry's successor as director of the survey, will be willing to admit that there is the slightest foundation for what is implied in the last phrase; and those who are familiar with the history of that period of the survey know that Dr. Newberry's failure to continue as its head was not due to a change in political administration in Ohio.

During twelve of the sixteen years covering the entire period in which Dr. Newberry may be supposed to have had any sort of connec-

tion with the survey, governors of the state were of the party which was in power when it was inaugurated through the interest and initiation of President Hayes, himself twice governor during those years.

Nor is there any evidence to show an attitude of personal unfriendliness towards Dr. Newberry or the survey on the part of the two governors belonging to the other political faction, each of whom served one term.

The plain truth seems to be that for the discontinuance of appropriations for the support of the survey under his administration and for the final ending of it by legislative enactment in 1882, Dr. Newberry, himself, was largely if not entirely responsible, though the financial crisis through which the whole country was passing during the early 70's doubtless had much to do with the limitations put upon its operations.

The people of Ohio had been led to believe that the economic and especially the mineral resources of the state would be developed by the survey and it is not surprising that there was impatience when after the lapse of ten or fifteen years nothing of great value on this phase of the work had appeared.

Instead there had been published elaborate reports upon paleontology, involving large expense for beautiful (and valuable) plate illustrations, the cost of which for a single volume being as much as $34,000.

After three years the legislature modified the organization by creating a geological board consisting of the governor, school commissioner and the state treasurer, which was charged with the general supervision of the survey, though this had, apparently, little effect upon the program of its operations.

Volume 4 of the series of reports was published in 1882, thirteen years after the beginning of the work and was devoted entirely to vertebrate zoology.

In the meantime Dr. Orton, who had been one of Newberry's principal assistants, had been especially interested in the economic and mineral resources of the state, the extent of which was hardly realized at that time, and material for Volume 5 had been gathered. In April 1882 the legislature made an appropriation for the cost of publishing this volume and at the same time announced that "upon the publication of said Volume 5 the Geological Survey of Ohio is hereby declared to be completed."

It was also provided in the same Act that the publication of this volume should be in charge of a geologist to be appointed by the governor.

The governor, the Hon. Charles Foster, promptly appointed Dr. Orton, who had recently resigned the presidency of the Ohio State University, which he had held from its organization in 1873, in order to devote his entire time to the professorship of geology in that institution.

In 1884 Volume 5 was published, being devoted almost entirely to coal. It has always been the most sought after publication of the survey and the reaction to its appearance was a provision by the legislature "to extend and complete the account of the economic geology of the state that was begun in Volume 5." In 1888 Dr. Orton published a volume on petroleum and natural gas which has been esteemed as equal in value to Volume 5.

The survey became and has continued to be popular with the people of the state and it has ever since been "a going concern." On the death of Dr. Orton in 1899 he was succeeded by his son, Edward Orton, Jr., whose development of the ceramic interests and methods of the state were of nation-wide importance. Desiring to devote most of his time to this special field he resigned in 1906 and was succeeded by the present incumbent, Professor J. A. Bownocker who had served as assistant geologist for several years, and who also fills a chair of geology in the state university.

It is true that the fact of Dr. Newberry's absence during a large part of each year, especially during the winter when the legislature was in session, had a good deal to do with the dissatisfaction which developed a few years after his work began. Although born in Connecticut he was, at the age of two years, brought to Ohio by his parents and the state in which he grew up and was educated always regarded him as one of her illustrious sons.

He was a paleontologist rather than a geologist but if he had been tactful enough to place the emphasis of the earlier years of the survey upon those phases of it in which the people

were vitally interested the story of his connection with it might have been different. As it was Ohio saw adjoining states rapidly developing their mineral resources as the result of geological surveys while her own organization seemed to be producing only beautifully illustrated volumes concerning fossils.

There are enough sins legitimately left at the door of state and national legislatures, in connection with their dealings with science, without adding to their number the failures and mistakes which should really be charged to men of science themselves.

T. C. MENDENHALL

RAVENNA, OHIO
NOVEMBER 7, 1922

THE COLLOIDAL STATE

EDITOR OF SCIENCE: It seems that one important basis of the anomalous behavior of matter in the colloidal state of subdivision lies in the fact that, in the colloidal zone, increase in dispersion is accompanied by a disproportionately large increase in kinetic activity of the ultramicrons, which reaches an extreme at atomic or molecular dispersion. The speed of motion of ultramicrons is itself the resultant of several factors (including size, temperature, viscosity of dispersion medium, concentration, free electronic fields, etc.), but it probably exercises a very considerable influence in reactions where colloids are involved, *e.g.*, diffusion, adsorption, enzyme action, etc.

For some time I have been accumulating data bearing on this question, and would be pleased to hear from any readers of SCIENCE who know of pertinent experimental facts. Thus Zsigmondy ("Colloids and the Ultramicroscope") has given the size of certain gold ultramicrons and their relative amplitudes of motion. Ultramicrospic examination indicates that gel formation involves aggregation with cessation of visible kinetic activity, and the zone of maximum degree of colloidality (J. Alexander, *J. Am. Chem. Soc.*, 43, p. 434, 1921) may be that zone where the curve of free surface plotted against particle size, approaches and crosses the curve of kinetic motion plotted against particle size.

An investigation will also be made of the variations in size of ultramicrons and ultramicroscopic activity with changes in free acidity (H-ion concentration or p_H value).

JEROME ALEXANDER

50 EAST FORTY-FIRST STREET,
NEW YORK CITY,
NOVEMBER 13, 1922

NOTE ON THE FUSARIUM WILT DISEASE OF BANANAS

IN the journal, *Phytopathology*, of September, 1919[1], Dr. E. W. Brandes described in detail his out-door pot inoculation experiment, demonstrating that *Fusarium Cubense*, E. F. Smith is the cause of the very destructive wilt disease of the banana, heretofore generally known as the Panama disease. Since then there has been published in Java a paper by E. Gaumamm on a vascular disease of the banana[2], in which the author attempts to discredit the work of American investigators of this disease, but particularly that of Dr. Brandes. In a statement by Brandes, of which the writer has a typewritten copy, he reviews Gaumamm's paper and points out various errors and confusion of facts. As the writer, while connected with the United Fruit Company, recently conducted an experiment of exactly the same kind as the one by Brandes above mentioned, it may be important to those interested to briefly describe this experiment and the results. The experiment was made just outside the Company laboratory, in Changuinola, state of Bocas del Toro, Panama. In this case the common Gros Michel banana was employed, instead of the variety Chamalucco employed by Brandes. Otherwise the two experiments were almost perfectly parallel except as to locality.

This experiment was begun November 1, 1921. Twenty-five cement pots were employed, set in corresponding holes in the ground, and

[1] Brandes, E. W., Banana Wilt. *Phytopath.* 9. No. 9, pp. 339-389, pl. 22-34, 1919.

[2] Gaumamm, E., Over een bactericele Vatbundelziekte der bananen in Nederlandsch., Indie. Meded. V. H. Instituut V. Plantenziekten, No. 48, Dept. N. Landbouw, Nijverheid en Handel, pp. 135, pl. 8, 1921.

the excavated soil afterward returned. They were square, 3 feet each way at top, 4 feet deep, and open at bottom. Sterilizing the soil was done by a Company railway engine, the soil in each pot being steamed two hours, at 110° C. Fourteen pots were thus sterilized and the remaining six were neither sterilized nor inoculated. All the pots were planted with one "bit" of a banana tuber having two "eyes" and in seven of those sterilized these bits were inoculated with a laboratory culture of *Fusarium Cubense,* while the other seven were not inoculated. The inoculum was a combination of two kinds of culture-mixed at time of application—one in corn meal decoction and the other in Ushchinski's solution, both originating from rice tube cultures, three weeks previously. It was applied in quantity of about one liter to each pot. Already in February, 1922, one of the inoculated plants showed signs of disease. By April 1 every one of the inoculated plants was diseased and most of them were even then bad cases. Up to July 12, when the writer left Panama, no one of the plants in the inoculated pots, either sterilized or unsterilized, gave any indication of disease. Besides the added interest that may be attached to this experiment, with a different variety of banana in a different locality, the writer is glad, and others will be, that it confirms the painstaking work of Dr. Brandes. It should be added that Dr. J. R. Johnston, director of tropical research for the United Fruit Company proposed the experiment, in which the writer was also supported and encouraged by the manager, H. S. Blair, and by H. L. Peck, E. C. Adams, and other men of the Company.

MARK ALFRED CARLETON
CUYAMEL, HONDURAS

FRESH WATER COELENTERATA IN KENTUCKY

IN 1916[1] the writer called attention to an extraordinary appearance of the rare fresh-water medusa, *Craspedacusta sowerbyi,* in a Kentucky creek, when it was present literally by the thousands, and expressed his intention to make a search for the hydroid stage of the jellyfish, since the indications were that where so many of the sexual form occurred there should be a good prospect of finding the asexual stage. With this in view visits have been made from time to time to the place where the medusæ were found. In 1917, a year after they were first observed, they were present again in as great numbers as in the preceding year[2]; still no trace of a hydroid condition could be found. Each year thereafter the place was searched, but they have not been seen since 1917. It may be of interest to record, however, that this year (September 26) when examining the locality, some fine growths of the hydroid *Cordylophora*[3] were obtained in the part of the stream where *Craspedacusta* was discovered. There can be no doubt about this material representing *Cordylophora lacustris,* and this interesting fresh-water hydroid is thus given a new locality in which it is associated in a way with *Craspedacusta.* The growths are attached to living willow twigs that by the drooping of branches have become immersed in the water.

HARRISON GARMAN
UNIVERSITY OF KENTUCKY
LEXINGTON, KY.

AN ANNOUNCEMENT IN SCIENCE

TO THE EDITOR OF SCIENCE: I am glad to be able to inform you that in response to my appeal on behalf of Professor W. Boldyreff, published in SCIENCE of October 27 under the heading, "An Opportunity," I received promptly a number of requests for special information concerning Dr. Boldyreff's qualifications, and that as a result of these inquiries he has now received an appointment for a year in a dignified position which will give him excellent opportunity for research work and an income to keep himself and family alive.

VERNON KELLOGG
NATIONAL RESEARCH COUNCIL,
WASHINGTON, D. C.,
NOVEMBER 28, 1922

[1] SCIENCE, Vol. XLIV, page 858.

[2] Professor Hargitt in commenting on the matter (SCIENCE, L. 1919, page 413) was wrong in inferring that they disappeared at once.

[3] A medusa stage is believed not to be produced by this hydroid.

QUOTATIONS

INSULIN AS A CURE FOR DIABETES

ON another page we print an important communication from the Medical Research Council relating to a promising remedy for diabetes recently discovered at Toronto. Diabetes is one of the more serious afflictions of mankind, insidious in its beginnings, debilitating in its course, and often fatal. At present the treatment is little more than an effort to prolong life by a regimen of habit and diet so arduous as to make it very irksome. Dr. F. B. Banting, a young physician attached to the University of Toronto, acting on the known fact that extirpation of the pancreas in dogs is followed by a diabetic condition, thought it possible that the secretion discharged into the blood by that gland might be the factor inhibiting the onset of the disease, and that its administration in some form might prove a remedy. Experimental work confirmed his theory, which has, in fact, been thought probable for many years. A substance, to which the name "insulin" has been given, extracted from the pancreas of the ox, pig or sheep, when injected into the veins of human diabetic patients has frequently given quick relief, and has appeared to lead towards cure. But the remedy is still in an early stage. The exact constitution of insulin, as, indeed, of many other of the subtler animal essences, is still unknown; its preparation demands high skill and special methods; its administration must be watched by expert physicians. In the opinion of the medical faculty of the University of Toronto, of their American colleagues and of representatives of our own Medical Research Council, any premature exploitation of insulin might gravely disappoint the public, and even prevent the ripening of the hopes of these high authorities. It has therefore been decided to protect and control its manufacture and use in the United States and in Canada. Similar protection and control in this country have been offered to and accepted by the Medical Research Council. To protect the public and to perfect a great boon are objects which command respect. But while recognizing that special circumstances may in this case justify it, we are not entirely reassured about the method—a feeling that seems to have given an apologetic tone to the communication issued by the Medical Research Council. For it is proposed to patent the remedy—a course excluded from the practice of the Pasteur Institute. Pasteur and Metchnikov determined that their discoveries should be offered as a free gift to the world, although the possibilities of fraudulent or foolish exploitation by others, of mistaken use, and even of employing the revenue from patents for further research were present to their minds.—*The London Times.*

JUSTICE FOR THE PUEBLO INDIANS

IN formally protesting against the passage of the Bursum Pueblo Indian Bill the American Ethnological Society took account only of the plain facts. It is a thoroughly vicious measure, designed to put a premium on fraud and to commit the United States government to a sweeping raid on the lands and water rights of the New Mexico Indians. The council of the Peabody Museum of American Archeology and Ethnology of Harvard uses very moderate language when it calls public attention to "the iniquity and hardship" of the bill to the end that it be defeated.

The Bursum bill was put through the Senate on the strength of misleading statements. The scheme could not be worked again. Full publicity would prevent it. For a little publicity has already rallied to the support of the cause of the Pueblo Indians disinterested persons and organizations that will not desert them or be lulled to sleep as the Senate was.

These Indians, living peacefully in some twenty tribal groups, have been steadily crowded off lands confirmed to them by the United States government by outsiders having no valid titles. The government is bound to protect them as its wards, but it has failed to do so.

But as it turns out, the Pueblo Indians, though voteless, are not friendless. It is a wholesome sign that before they had united in voicing their own protest against the Bursum bill, friends from many quarters had volunteered assistance and accepted the burden of the fight in their behalf. Congress and the administration can not afford to be indifferent

to the flood of protest pouring in on them against this betrayal of the Pueblo Indians for the sake of a few New Mexico land-grabbers.—*The New York World.*

SPECIAL ARTICLES

SERIES REGULARITIES IN THE ARC SPECTRUM OF CHROMIUM

THE detection of two sets of related triplets, by Meggers and Kiess, in the course of their work on the arc spectrum of chromium, induced the present writers to undertake a more thorough examination of the spectrum, to find, if possible, other regularities which might lead to series relationships. While a detailed discussion of the work has not yet been completed, enough has been found to warrant the following statements.

At least three sets of series whose members are triplets, occur in the arc spectrum of chromium. Of these, two sets are composed of wide triplets, and one set of narrow triplets. The wide-triplet series are parallel; that is, there exists a constant difference between the wave numbers of homologous members. Each component of the first member of the diffuse series is itself a narrow triplet. In the table are given data for the first members of the principal, sharp and diffuse series of the two parallel systems:

λ I. A. (Vacuum)	ν	Δν	λ I. A. (Vacuum)	ν	Δν	Separation
p			*p*			
4255.53	23498.84	112.44	3579.69	27935.38	115.10	4436.54
4275.99	23386.40		3594.50	27820.28		4433.88
4290.92	23305.02	81.38	3606.35	27728.86	91.42	4423.84
s			*s*			
7464.39	13396.94	112.45	11160.2	8960.4	115.2	4436.5
7402.26	13509.39		11018.6	9075.6		4433.8
7357.95	13590.74	81.35	10908.8	9166.9	91.3	4423.8
d			*d*			
5331.18	18757.57		6982.79	14320.92		4436.65
5330.58	18759.68		6981.75	14323.06		4436.62
5329.80	18762.43	112.78	6980.23	14326.18	115.16	4436.25
.....	.....		6927.90	14434.39		.....
5299.32	18870.35		6927.09	14436.08		4434.27
5298.81	18872.16		6925.96	14438.43		4433.73
5277.56	18948.15	81.29	6885.00	14524.33	91.54	4423.82
5277.09	18949.84		6884.23	14525.96		4423.88
5276.59	18951.64		6883.40	14527.62		4424.02

The narrow triplets which constitute the third set of series are characterized by the frequency differences $\Delta\nu_1 = 8.80$ and $\Delta\nu_2 = 5.65$. Several doublets in which each of these separations exists and also one with the separation, $\Delta\nu = 81.37$, have likewise been found. These are suggestive of inter-series combinations.

C. C. KIESS
HARRIET KNUDSEN KIESS
WASHINGTON, D. C.,
OCTOBER 10, 1922

THE NATIONAL ACADEMY OF SCIENCES

THE autumn meeting was held in New York City on November 14, 15 and 16, on successive days at Columbia University, the Rockefeller Institute for Medical Research and the United Engineering Societies Building. The scientific program was as follows:

Biographical memoir of Harmon Northrup Morse. (By title) IRA REMSEN.

A catalogue of bright stars, a compilation of all the known data concerning the 9110 brightest stars: FRANK SCHLESINGER. The requirements for an abstract are perhaps sufficiently complied with by the title itself, but it may be well to say in addition that the catalogue gives the name of each star, its position for 1900, the Durchmusterung number, magnitude, spectrum, proper mo-

tion, parallax, radial velocity and notes concerning other points of interest.

The status of research on the perturbations of minor planets with special reference to its ultimate significance: ARMIN O. LEUSCHNER.

The structure of the Jura Mountains in France. Lantern: EMANUEL DE MARGERIE (introduced by J. F. Kemp).

Recently discovered evidence bearing on the age of the Sierra Nevada. Lantern: JOHN C. MERRIMAN, R. W. CHANEY and C. STOCK.

American jade and its archeological bearing. Lantern: HENRY S. WASHINGTON. Microscopic study of many jade objects from Chichen Itza, Copan and localities in Mexico shows that the material consists of a jade-like pyroxene and albite in different proportions; varying from pure pyroxene to nearly pure albite. The pyroxene is composed of jadeite and diopside, the combination forming a hitherto unrecognized member of the pyroxene group. Many chemical analyses have been made, and these, as well as the microscopic thin sections, show that the albite is soluble in the diopside-jadeite up to a certain amount, beyond which it crystallizes out separately. In chemical and mineral characters the Middle American jades differ markedly from those of Burma and Tibet, the chief sources of Chinese jade. These differences, the occurrence of a complete series of the rocks, and the original pebble form of many of the American jade objects, indicate that the material of the Mexican and Central American artifacts is of American, and not of Asiatic, provenance; thus being adverse to the theory of southeastern Asiatic origin for Middle American races and culture. This American jade has not yet been found in place, but it is probable that it comes from toward the Pacific coast, and two centers of production are suggested as probable, Oaxaca-Guerrero in Mexico and Guatemala in Central America.

Drowned coral reefs of the Liu Kiu Islands, JOHNSON (introduced by J. F. Kemp).

A genetic description of some New England-Acadian shorelines. Lantern: DOUGLAS W. JOHNSON (introduced by J. F. Kemp).

A tentative geological column for central Mongolia: CHARLES P. BERKEY (introduced by J. F. Kemp).

Xenoliths in the Stony Creek granite, Connecticut: JAMES F. KEMP.

A chemical investigation of two typical enzymes: pancreatic and malt amylases: H. C. SHERMAN. This paper reviews briefly some of the results obtained in an investigation carried out during recent years with the aid of grants from the Carnegie Institution of Washington, and describes unpublished experiments which furnish a new line of evidence that these enzymes, in their chemical nature, either are proteins or contain proteins as essential constituents. While alike in this respect, these two starch-splitting enzymes differ markedly in some of their properties and are undoubtedly different substances. Some of the chief points of resemblance and of difference are briefly summarized and the problem as to the conclusiveness of the evidence regarding the chemical nature of these enzymes is considered.

The hydration of sodium monometaphosphate to orthophosphate in varying concentrations of hydrogen ion: H. T. BEANS and S. J. KIEHL. The preparation of sodium monometaphosphate; method of following the hydration; experimental data; formation of pyrophosphate as an intermediate product; discussion of results.

Saturated Bredig gold sols: H. T. BEANS and L. B. MILLER. Briefly summarized the paper will present the results of the continuation of our work on the study of the influence of electrolytes on the composition and behavior of gold sols made by the Bredig method. We have found that a very definite quantitative relationship exists between the maximum amount of gold which can be dispersed by the Bredig method, and the character and concentration of the electrolyte present. The paper will, therefore, consist in a demonstration of this relationship with curves and data which are in support of the conclusions.

Experimental studies on the hydrogen electrode: H. T. BEANS and L. P. HAMMETT. A study of the practical application of the hydrogen electrode and of theoretical questions involved has shown that the hydrogen electrode must function not only as an inert electrode, but as a catalyst for the hydrogen ion reaction. Comparison of various methods for producing the necessary activity is of interest from the general point of platinum catalysis, and indicates the interesting problem of the potential difference between active and inactive electrodes. These results, together with the results of the study of the effect of oxygen upon the electrode have led to a specification of the necessary conditions for precise measurements in buffered solutions, and investigation of the difficulties inherent in the application of the electrode to unbuffered solutions has led to the determination of the reasons underlying these difficulties, and to a new type of electrode which

gives satisfactory results in solutions of potassium chloride.

The interdependence of solvent and solute in ionization phenomena: JAMES KENDALL and MALCOLM M. HARING. In a previous communication (Kendall, *Proc. Nat. Acad.* SCI. 7, 56, 1921) it was shown that compound formation and ionization in solutions proceed in parallel and that solvent and solute play an equally active part in ionization phenomena. The present article discusses the various possible ionic types which may be produced by the disintegration of compounds formed when two substances RX and R¹Y are mixed. Rules are deduced for predicting the relative amount of each type in any particular case from the character of the radicals concerned, and these rules are demonstrated to be in accordance with experimental results chosen from both aqueous and non-aqueous solutions.

Some unusual freezing-point curves in fused salt mixtures: JAMES KENDALL, E. D. CRITTENDEN and H. K. MILLER. In the course of a detailed study of the factors influencing compound formation and solubility in fused salt mixtures, by which 49 new double salts were isolated, some rather remarkable freezing-point curves were encountered. Two illustrative examples are here described. In the first—the system $AlBr_3$:NaBr—a two liquid layer region exists between 2.6 and 16.3 per cent. NaBr, and the freezing-point curve on either side of this descends from 95.4° to a eutectic point. The solid phase in equilibrium with the two liquid layers must consequently be a double salt of intermediate composition, unstable at its true melting-point but melting to give two immiscible liquids at 95.4°. In the second type of system, of which $SbCl_3$:$SnCl_4$ is an example, the two liquid layer region is metastable, but approaches so closely to the freezing-point curve as to induce it to become almost horizontal over a very wide range of composition.

Ferric hydroxide hydrosol: ARTHUR W. THOMAS and A. FRIEDEN (introduced by M. T. Bogert).

A citraconic analog of quinophthalone: M. T. BOGERT and K. ASANO. The well-known dye quinoline yellow (quinophthalone) is prepared by the action of phthalic anhydride upon quinaldine. It is now found that citraconic anhydride does not condense smoothly with quinaldine, but that when the imide is used in place of the anhydride, a dye analogous to quinoline yellow results.

Diaryl thiophenes and diaryl selenophenes: M. T. BOGERT and J. P. HERRERA. 2,4-Diaryl thiophenes and diaryl selenophenes may be obtained in fair yields from ketone anils, of acetophenone anil type, by fusion with sulfur or selenium. The properties of these new compounds and of various derivatives are described.

Factors governing the distribution of plants in Porto Rico and the Virgin Islands: NATHANIEL L. BRITTON.

Growth and form: ROBERT A. HARPER.

Growth and development of children as influenced by environmental conditions: FRANZ BOAS.

Dating prehistoric man in America by methods of distribution and stratigraphy: CLARK WISSLER (introduced by F. Boas).

Measurements on the expression of emotion in music: C. E. SEASHORE. The writer points out that every emotional effect transmitted by the singer or other musician through music is contained in the sound wave. This can be intercepted and recorded with high precision and the musical effects may then be classified in terms of the measurable attributes of the wave; namely, frequency (pitch), duration (time), amplitude (intensity and volume), form (timbre). All musical expression through sound may be expressed in terms of variables in these four factors.

Undernutrition and its influences on the metabolic plane of steers: FRANCIS G. BENEDICT and ERNEST G. RITZMAN. Based upon experiences with humans, who voluntarily underwent ration curtailment, and upon the well-known inequalities in the feeding habits of wild animals, a group of 11 steers were subjected to curtailed rations amounting to approximately one half of their normal maintenance requirements, for a period of about 140 days. Measurements of feces and urine and feed, as well as an extensive series of metabolism measurements inside of a specially constructed respiration chamber, made it possible to study these animals intensively. The curtailed rations resulted in a distinct loss of nitrogen and fat from the body, but the steers recovered their initial state by subsequent feeding with hay, concentrates or pasture. Although carried through the winter on an extraordinarily low metabolic plane, they suffered no permanent damage and all were subsequently fattened for market.

The acetonitril test for thyroid and of some alteration of metabolism: REID HUNT. (1) Toxicity of acetonitril; effects of undernutrition; diet; vitamins. (2) The acetonitril test for thyroid; the relation between iodin content and

physiological activity. Thyroxin. (3) The reaction as a test for thyroid secretion. Grave's disease.

Leucocytic secretions: ALEXIS CARREL (introduced by S. Flexner).

Experiments with an anti-serum for Rocky Mountain spotted fever: HIDEYO NOGUCHI (introduced by S. Flexner).

The protection of the newborn against infection: THEOBALD SMITH.

Experimental herpetic encephalitis: SIMON FLEXNER.

Hydrohepatosis, a condition analogous to hydronephrosis: PEYTON ROUS (introduced by S. Flexner).

Crystalloidal solutions and colloidal suspensions of proteins: JACQUES LOEB.

The ovary in connection with structural and metabolic changes in mammals: CHARLES R. STOCKARD. A general description is given of a method of external examination by which the several stages of the ovarian cycle may be definitely located. The moment of discharge of the ovum from the ovarian follicle may also be accurately determined. The several stages of the ovarian cycle may be experimentally modified and ovulation temporarily or permanently suppressed. The type of modification may be recognized by a study of the structural reactions of the uterus and vagina which are indicated by the cellular composition of smears collected from the wall of the vagina. The ovary may be used as a very exact and valuable indicator for determining the general metabolic conditions of the individual.

The mechanism of selective bacteriostasis: JOHN W. CHURCHMAN (introduced by S. Flexner).

The reduction division in haploid, diploid, triploid and tetraploid daturas: JOHN BELLING and A. F. BLAKESLEE (introduced by C. B. Davenport).

The consequences of different degrees of intermensual correlation for fecundity in the domestic fowl: J. ARTHUR HARRIS (introduced by C. B. Davenport).

Recent studies on the relation of metabolism to sex: OSCAR RIDDLE (introducted by C. B. Davenport).

Sex and sex control in Cladocera: (By title.) ARTHUR M. BANTA (introduced by C. B. Davenport).

The consequences of different degrees of interference, in the crossing-over of the hereditary genes: H. S. JENNINGS. The paper gives the general results of a mathematical study of the relations exhibited in the socalled crossing-over of the genes, and compares these with those bound to occur if the genes are arranged in series and there is interference between breaks at points near together in the series. The observed ratios fall into a peculiar and complex system; by means of a mathematical formula it is shown that this entire system, even to details, is, in all essentials, a necessary result of the serial arrangement with a certain extent of interference. The marked changes that would result from different extents of interference are likewise shown.

A new type of uroleptus formed by permanent fusion of two conjugating individuals: GARY N. CALKINS.

Restoration of fossil human remains its possibilities, value and limitations: J. H. MCGREGOR (introduced by Edmund B. Wilson).

The rôle of the golgi apparatus in the formation of the animal sperm: ROBERT B. BOWEN (introduced by Edmund B. Wilson).

The map of the third chromosome of Drosophila: T. H. MORGAN and C. B. BRIDGES.

Limiting values of the size of the genes of Drosophila: T. H. MORGAN.

Ultraviolet flowers and their possible bearing on the problems of pollination by insects: FRANK E. LUTZ and F. K. RICHTMYER (introduced by Frank M. Chapman). The various colors on the petals of flowers and, indeed, the petals themselves are rather generally believed to have arisen in connection with the pollination of flowers by insects. A few experiments, including some made recently, indicate that insects respond definitely to ultraviolet rays. This suggested an investigation of the reflection by flowers of ultraviolet rays. It was found that some flowers show ultraviolet while others do not, just as some show blue while others do not. If flower colors are important in connection with pollination by insects, its seems that not only the visible spectrum but also the ultraviolet should be considered.

Recent discoveries of fossil vertebrates in China and Mongolia: W. D. MATTHEW (introduced by Frank M. Chapman). Important fossil mammal faunas have been recently discovered in China by the Chinese Geological Survey and American Museum party. The American Museum's Asiatic Expedition has also been extraordinarily successful in Mongolia this summer. Three important mammal faunas, Eocene, Oligocene and Pliocene were discovered, also a rich Cretaceous dinosaur fauna. Large collections

were secured, including complete skulls and skeletons and their study is expected to throw much light on the origin and dispersal of the higher vertebrates and of men.

The Whitney South Sea expedition of the American Museum of Natural History: ROBERT CUSHMAN MURPHY (introduced by Frank M. Chapman). For more than two years the Museum has been conducting ornithological investigations in Polynesia. This paper summarizes the purposes and accomplishments of the expedition, and outlines some of the problems involved in studying oceanic and insular zoology.

Mutations among birds in the genus Buarremon: FRANK M. CHAPMAN. From a study of the 160 specimens of *Buarremon brunneinucha* and *B. inornata* in the American Museum of Natural History the following conclusions are reached: (1) That *Buarremon inornata* is a representative of *Buarremon brunneinucha.* (2) That the variations in pattern and color occurring in the underparts of *brunneinucha,* throughout the range of that species, are individual and are not due to age, sex or season, to climate or other observable environmental factors. (3) That isolation, partial or complete, has alone supplied the conditions needful to the development and establishment of these characters as the specific attributes of *Buarremon inornata.*

On the attraction of a central body in the theory of relativity: GEORGE D. BIRKHOFF.

The equiaffine geometry of paths: OSWALD VEBLEN.

The cosmological equation of gravitation: EDWARD KASNER. It is shown that the two sets of equations introduced by Einstein in 1917 and 1919 are exactly equivalent in empty space. The cosmological factor λ can then be proved to be a constant, instead of being so assumed.

A theory of the various transverse effects of the magnetic field in several metals: EDWIN H. HALL.

The photo-luminescence of flames: E. L. NICHOLS and H. L. HOWES. When flames containing salts of Na, Li, Ca, Ba, Sr, etc., are exposed to light the bright bands in their spectra, in general, are enhanced. The effect, although large compared to ordinary fluorescence, forms a small part of the total brightness of the flame and can not be readily detected except by spectro photometric methods. As in ordinary photo-luminescence *excitation is by wave-lengths shorter than those of the band itself.* There is a *measurable quenching by exposure to the longer wave-lengths* and specifically to light identical with the band. So far as now known no new bands are developed as the result of excitation. The light sources thus far used as excitants are the tungsten lamp, carbon arc, mercury arc and iron spark.

The reflection of X-rays by crystals: WILLIAM DUANE.

The analysis of certain crystals by the new X-ray method: G. L. CLARK and WILLIAM DUANE.

The use of isophelimatic lines in historical geography; A new theory of population; A new hydrodynamical phenomenon; Further results in interior ballistics: ARTHUR G. WEBSTER.

The Thermal emissivity of water: MILDRED ALLEN.

The determination of ocean depths by acoustical methods: H. C. HAYES (introduced by W. H. Dall and W. M. Davis).

The gyroscope and its practical application in the arts. Lantern: O. B. WHITAKER (introduced by J. J. Carty and F. B. Jewett).

Electronic tubes of high power: H. D. ARNOLD, Ph.D. Recent developments in the construction of high vacuum apparatus have made possible the use of pure electron currents as large as 30 amperes in single tubes which are capable of controlling powers of 100 k. w. or more. This paper discusses some of the problems in physics and in engineering which were solved in the course of this development, particularly those which relate to the construction of glass and metal apparatus suitable for use with these high powers. The paper will be illustrated by samples of the tubes and by slides showing the general features of their construction.

Carrier type multiplex telephony and telegraphy: E. H. COLPITTS. The underlying principles of carrier are discussed particularly as they apply to carrier telephony, first, where a single channel of communication is provided, and secondly, where a number of channels are provided over the same pair of wires. Apparatus is shown illustrating the various physical steps in the process of transmitting speech from one terminal station to the other. Particularly the performance of filters in discriminating against the passage of currents outside of the band which they are designed to transmit is demonstrated. In these demonstrations use is made of a loud speaking telephone.

Spectrum energy curves of the stars: CHARLES G. ABBOT.

Affine geometries of paths possessing an invariant integral: LUTHER P. EISENHART.